than the random sample mean of .88. Much of this difference might be explained, however, by the larger number of basic channels (and, therefore, the ability to provide more program services on overbuild systems). The average overbuild carries an average of 38 channels, 24 of which are cable networks (i.e., delivered via satellite). The numbers are 29 and 18 for the average system in the random sample. In other words, the overbuilds provide over 30 percent more program services.[9]

It is worth noting that, for the industry as a whole, about 60% of the observed variation in price per channel can be explained by differences in the number of channels offered. The FCC models explain from 63 to 67 percent of total variation, but very little of the remaining variation is explained by other factors. This suggests that the FCC model does not adequately explain the variation in monthly cable bills and that the respectable performances (e.g., as indicated by the R-squared statistic) of simple models explaining price *per channel* are somewhat misleading[10]. This implies that the models do not capture as much of the real world factors affecting price as one would like to have for policy analysis.

Overbuild Systems have more premium channels (not reported in Table 2), have more advertising revenue, more pay-per-view channels, and are more likely to have one and two-way addressability than systems in the FCC's

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[9]One might argue that the overbuild franchises carry more programming precisely because they are more competitive. However, this may well not be be the case. Our preliminary look at the evidence indicates that system age, to a large extent, dictates channel capacity. Capacity, not competition, appears to be the driving factor behind the number of channels provided.

[10]In fact, when one retains the basic structure of the FCC model and estimates the monthly rate as a function of satellite channels, total basic offerings and the reciprocal of subscribers, one gets almost identical results, but the R^2 falls to about .12. This is not necessarily a fatal flaw but it does indicate that extra caution in interpreting the estimates of variables that might be correlated with left-out variables, such as whether or not the system is an overbuild, is required.

random sample. Consequently, in general, Overbuild Systems rely less on basic revenue than do non-overbuild systems. For example, in the overbuild sample 53 percent of a system's revenue comes from cable fees for basic tiers (excluding equipment rental, installation, etc.). This figure is significantly higher at 61 percent for the representative sample.

This differential in dependence on basic revenue is probably driven by the fact that technological capabilities (pay-per-view, fiber, addressability, and local and commercial insertions are more generally found in overbuild systems). This has predictable consequences for basic cable rates because Overbuild Systems, with access to relatively higher ancillary revenue from subscribers (this is true even if all revenue streams are reduced by competition), will try to gain access to that revenue by keeping basic prices relatively low.[11] Any model that ignores this difference between overbuilds and the rest of the industry is likely to overstate the competitive effect.

This technology-driven difference in pricing most likely stems from the contrasting distributions of headend age for the random versus the overbuild sample. As Table 2 reports, overbuilds are more likely to be 5-years old or younger. In addition, 20 % of the overbuild sample, compared with 13 % for the random sample, have headends that are 20 or more years old and are likely to be rebuilt sooner than others. If new or rebuilt systems start out with lower rates to achieve a threshold of penetration, or to gain consumer acceptance or overcome an established incumbant, simple models that ignore

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[11]It is instructive to look at other industries to illustrate this point. In the newspaper industry, when *USA Today* failed to make inroads into national advertising markets (arguably because of rigorous competition with alternative national media with greater household penetration) the subscription price was increased. On the other hand, most daily newspapers, especially those with relatively more market power in the local advertising market, charge subscription prices that may not even cover the cost of the newsprint.

such dynamics could very well overstate the long-run equilibrium effect on prices of overbuild competition.

In addition, overbuilds are much more likely to be located in the South (over 54% compared with 30 % for the random sample), with notably lower costs than other regions. On the other hand, 28% of the industry's systems are located in the higher cost Pacific or Mountain regions while only 3 % of the Overbuild Systems are located in these high-cost parts of the country. Consumers in these Western regions also appear to use the mass media less intensely than their counterparts elsewhere.

Finally, 41 percent of the industry's systems are located in communities that receive at least 6 television signals over the air (previously determined by the FCC to provide effective competition to cable).[12] In contrast, fully 71 percent of the nation's Overbuild Systems are in markets where consumers have free access to what the FCC used to consider effective competition. In fact, previous work suggests that price per channel falls by 12 percent where 6 over-the-air signals exist.[13] Since 30 percent more of the overbuild markets have such over-the-air competition, it would seem that the FCC's omission of the variables reflecting this competition from its model might inappropriately add 4% (30% of 12) to the estimate of the effect of overbuilds on pricing.

Although it is not possible to prove *a priori* , this discussion suggests that the omitted variables identified above are likely to overstate the estimated effect of overbuilds on pricing and consequently the FCC's study appears to result in an unreasonable competitive standard. While it does have some of the requisite measures, the FCC data base does not include enough information

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[12]Although the FCC data base does not provide information on broadcast alternatives to cable, deriving an industry estimate was made possible by using the NCTA data base and reweighting appropriately for sample comparability.

[13]James N. Dertouzos and Steven S. Wildman, "Competitive Effects of Broadcast Signals on Cable," February 22, 1990.

for testing the severity of the bias we have identified. However, the NCTA data base is more comprehensive and we hope to conduct a more thorough

B. Preliminary Results on the Effects of Competition on Cable Systems

In Table 3, we report some preliminary regression results explaining basic cable prices (on the lowest tier), subscribers, and total channels carried on basic tiers.[14] These models estimate the relationships between these outcome measures (in log-linear form) and a variety of exogenous market and system characteristics, including households, median household income, region of the country, and channel capacity. Also included are other measures of competition, including whether the system faced six over-the-air television signals[15] or direct overbuild competition in the local market.

Although the results are not directly comparable with the FCC benchmark results, they do cast significant doubt on the conclusion that overbuild competition can affect cable rates by as much as 30 percent or more. In particular, our study indicates that overbuild competition appears to reduce the price of the lowest tier of cable programming by 7 percent (though this result is not significant at the 95% level of confidence). In addition, the number of basic tier channels is about 5 % higher for an Overbuild System, all other things being equal.[16] Taken together, these two effects represent about

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[14]The FCC's analysis focused on average revenues per channel per subscriber, including revenues from all basic tiers, equipment rentals, and related services. We believe that more information is obtained when one looks separately at the separate business decisions that affect average revenues per channel per subsciber. In other words, we looked at first tier basic prices, the number of channel offerings, and subscribers.

[15]In this analysis, we analyze a dichotomous variable indicating the presence of at least six off the air television stations. This cutoff represents the most recent standards for effective competition based on broadcast signal availability.

[16]Recall from Table 2 that Overbuild Systems averaged 38 channels while the FCC's random sample averaged 29 channels, a 31% difference. However, once one controls for other factors, most notably channel capacity, the difference is only 5 percent. In other words, only 5 of the 31 percent can be interpreted as being the result of overbuild competition. The rest is due to factors not taken into account by the FCC models.

a 12 percent rise that is significantly different from zero. The effect on the number of cable subscribers is significant as well. An Overbuild System will generally have about 14 percent fewer subscribers than other systems, all things equal.

Even more provocative is the finding that over-the-air television seems to have a competitive effect that is similar to the effect due to the presence of overbuild competition. For the three measures of cable pricing, number of subscribers, and number of channels on a system, changes due to the presence of six over-the-air (OTA) signals is about the same as the response to direct overbuild competition. In addition, our study provides estimates for a regression adding an interaction term representing the simultaneous presence of both types of competitors (overbuilds and six over-the-air signals). The results are reported in the third column of Table 3. The separate coefficients on the OTA and overbuild variables represent the changes that occur when only one of the two types of competition exists in the market. In each instance the subscriber declines are both nearly 30 percent. In contrast, when one type of competition already exists, the marginal effect of adding more is not significant.

This result bears further scrutiny. This strongly suggests that while the economic value of overbuild competition can be quite high, the effects only occur when there does not already exist effective competition in the form of six over-the-air signals. This is a very critical issue which must be further explored.

Table 3

Competition and Cable System Outcomes:

An Analysis of the NCTA Data Set

	Dependent Variable, Log of:			
	Lowest Tier Price	Total Basic Subscribers	Total Basic Subscribers	Total Basic Channels
Intercept	2.346	-1.113	-1.122	-0.086
log(households)	-0.078*	1.007*	1.019*	0.079*
log(income)	-0.066	0.067	0.141	0.038
log(head end age)	0.043	-0.018	0.008	0.0002
MSO > 1 million subs	-0.132	0.020	0.057	0.006
6 or more OTA TV	-0.070	-0.141*	-0.292*	0.052
Overbuild Competition	-0.078	-0.149*	-0.261*	0.049
Simultaneous Overbuild and OTA Competition	--	--	-0.224*	--
R^2	.25	.98	.98	.81

Regression models also controlled for regions and channel capacity

IV. Implications of the FCC's Original Benchmark for the Cable Industry

In this section, we describe some of the likely implications of the FCC benchmark methodology for cable systems. We will demonstrate that, even assuming an accurate assessment of a competitive overbuild effect (an assumption we believe is unwarranted), the FCC's methodology produced benchmarks that are too low given factors affecting cost for most cable systems and that are biased against companies having particular characteristics and/or which are located in certain regions of the country.[17]

A well-known statistical property of log-linear models such as the FCC's is that they do not provide straightforward estimates of the absolute levels of the variables they are used to predict.[18] In most instances, there is a bias that

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[17]Although we emphasize these two particular biases in our discussion, we do not mean to imply that there are no other biases of equal importance. In particular, we have already mentioned that the results are rather sensitive to the presence of data anomalies. In addition, we found the estimated effects to be quite sensitive to functional form. For example, using the average channels per subscriber rather than the total channels available as an explanatory variable changes the results. Finally, since the measures of subscribers and the number of program offerings are endogenous outcomes that are affected by the presence of competition, the estimates are going to be polluted by simultaneous equation bias. Although we did not have the time to pursue the implications of these issues in great detail, preliminary results suggest that there are likely to be problems, particularly in terms of variation in the benchmark intended to reflect variation in the circumstances faced by different cable systems.

[18]This can be seen in a simple arithmetic example. Presume that a study is interested in an economic outcome such as the monthly price of cable television and is using a statistical model that predicts the logarithm of price. If there are two system prices in the market, one charging $30 and the other $20, the average is $25. In a more sophisticated way, a regression-based benchmark is really only a sample average, standardizing for other factors related to price. If the model yields predictions for the log of price, a perfect model would yield: log(20) and log(30) or 3.00 and 3.40, for an average of 3.20. Transforming back to get a prediction for the price levels is done by taking the exp[log(X)] = X, or exp(3.20) which is equal to 24.53. Thus, the sample average is understated by about two percent. The bias is correctable in a regression framework.
Under circumstances where there is no systematic relationship between the regression errors (where the error is given by the actual minus the predicted value of the cable rate per channel), the correct multiplicative transformation to obtain unbiased estimates of the levels from a log-linear specification is the

can be removed with a simple correction (the average of the exponentiated regression errors). The FCC made no correction even though, for the FCC model and data, we computed that this corrective factor should have been 1.036. This implies that the mean sample prediction would have to be inflated by almost 4 percent to get benchmark levels that accurately reflect industry price levels in the absence of competition. The resulting price levels are then adjusted downward to reflect the rates that are presumed to prevail in a competitive situation.

To illustrate this bias and the nature of the correction, our study generated individual predictions for each of the firms in the FCC's random sample of firms. Table 4 summarizes the calculation generated by substituting sample values into the FCC regression equation and then taking the exponential of the prediction of the log. This represents the FCC methodology for computing benchmarks for individual franchises. The average of these predictions is 85 cents per channel, while the true average for the sample is 88 cents. The average prediction of 85 cents, when reduced by the estimated competitive effect (about ten percent), in the FCC's current proposal, yields a rate target of 77 cents per channel. Since the FCC methodology does not make the required correction, this would represent about a 13 % rollback, not the intended 10 % reduction for a typical cable franchise not subject to overbuild competition.

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mean of the exponentiated residuals. See Naihua Duan, "Smearing Estimate: A Nonparametric Retransformation Method," *Journal of the American Statistical Association*, September 1983.

Table 4

Comparing FCC Benchmarks with
Actual Cable Industry Rates
(Average Firm Values $)

	Cable Rates, Actual and Predicted[a]
Actual per Channel Rates	.88
Benchmark Based on 10% Reduction From Actual Price	.79
Mean Prediction from FCC Model	.85
Benchmark Based on 10% Reduction: From FCC Prediction	.77

[a] Calculated from FCC weighted Average Formula

Given our calculation of the benchmarks which indicates that the rollback is 30 % greater than thought, we evaluate more accurately the implications for future cable rates for the industry as a whole. Table 5 reports our evaluation of the number of franchises likely to be affected by three alternative scenarios where the cable system is either (a) below the benchmark, (b) over the benchmark by less than 10 %, or (c) over the benchmark by more than 10 %. The first column of Table 5 describes the benchmarks as they are currently configured calling for a maximum 10

will have to reduce fees by the maximum 10%. The rest will have to rollback prices, but by less than the maximum. The average rollback for the whole industry will be just under 6.5%.

The next column assumes that the FCC recognizes and corrects the problem we have identified as being associated with predicting rate levels based on logarithmic statistical models. That would result in a 3.64% increase in the target benchmark for all franchises. As indicated, about 6% more of the franchises will now fall into the unregulated category. In addition, 12% fewer firms will be required to rollback the full 10 %. The average rollback will decrease by less than the 3.64% increase in the FCC's incorrect benchmark prediction, reflecting the fact that some franchises were already pricing below the benchmark and others will remain 10 % or more above the benchmark.

Finally, application of a 28% rollback would have a devastating effect on the industry. The vast majority of systems would be subject to mandated rollbacks. If franchises were required to adjust their benchmark by the entire 28 percent, two-thirds of the them would have to reduce rates by 20-28 percent.

Table 6

Effects of the Benchmark Model on Cable Regulation

	10% Rollback[a]	10% Rollback Unbiased Base[b]	28% Competitive Benchmark[c]
Percent of All Franchises:			
Below Benchmark (Unregulated)	27%	33%	3%
Rates < 10% Above Benchmark	20%	26%	3%
Rates > 10% Above Benchmark	53%	41%	94%

[a] Assumes a 10 % reduction from current model prediction.

[b] Assumes a 10% reduction from current model predicted adjusted upward for bias (3.6 %)

[c] Assumes a 30% reduction from current model prediction

Not only will the benchmarks have an overall effect that is likely to be devastating to undividual companies, but the burden will fall disproportionately on certain segments of the industry. We determined this by taking the computed benchmark for each system in the FCC's sample and then compared it to each system's actual price level. From this comparison, we were able to estimate what the rollback that would be necessary to meet the benchmark.

Table 6

Rate Reductions Necessary to Achieve Benchmark Based on 10 % Rollback

Franchise Characteristics	Rate Decline to Meet Benchmark
Average Firm (Industry Mean)	13%
Typical Firm Located in Pacific Region	20%
For Franchise Older than 20 Years	10%
Large MSO (100 Plus Systems)	19%
Firm Having Single Tier of Service	16%

As Table 6 indicates, the average firm would have to rollback prices 13 % to meet its benchmark even though the intended rollback is supposed to be 10 %. The rollback exceeds 10 % because of the 3.64 % biases stemming from the FCC's failure to make appropriate corrections to the benchmark formula. This is because the competitive effect is estimated to be 9-10% and the bias stemming from the FCC's failure to use the appropriate correction adds 3.6%. For a franchise with a headend 20 years or older, the rollback is less dramatic,

requiring only a ten percent reduction. However, for firms having a single

pricing that would be engendered by effective competition and not by factors extraneous to such competition.

In our study, we have examined the data and methodology employed by the FCC to generate the pricing benchmarks it has proposed. We have analyzed the degree to which the FCC's benchmarks meet the objectives of the Cable Television Consumer and Competition Act of 1992 and have found both that the data and the methodology used by the FCC have serious flaws. As a result, we believe that the proposed benchmarks are too low and that the effect of overbuild competition on basic rates would be vastly over estimated if a 28 percent pricing differential attributable to effective competition were adopted. In addition, we believe that the FCC's underlying methodology for

analysis suggests that the likely effect of not allowing for these differences is not only to greatly overestimate the effect of overbuild competition but also to introduce significant biases that would likely disadvantage certain segments of the cable industry, i.e., larger systems, franchises located in high-cost regions, and those with fewer tiers of services. These inequities should be addressed in a redesigned benchmark methodology. We see no reason, aside from relatively minor costs of implementation,[22] that would warrant the exclusion of factors likely to be related to the costs of providing cable television services.

We were able to evaluate the FCC's study using more complete information compiled by the NCTA. Since we were able to replicate the FCC's results using their methodology, we feel confident in the reliability of conclusions based on a supplemental analysis of the NCTA data. When we accounted for the biases in the FCC methodology, we found that the likely magnitude of the overbuild competitive effect is indeed similar to the ten percent wedge imbedded in the original benchmark schedule proposed by the FCC.[23] Regardless of any economic theory for excluding the low penetration franchises in the competitive grouping which the FCC may believe it is appropriate to adopt, it appears that the answer one gets by including them in the FCC model is closer to the truth, primarily because their inclusion partially offsets the biases that move in the opposite direction. In the absence of a complete overhaul of the underlying methodology, equity dictates that Low Penetration Systems be retained as part of the "effective competition" group.

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[22]Although we are sympathetic to the desire to reduce administrative burdens, the social wealth at stake is enormous.

[23]Also, recall that the benchmark prediction from which the competitive effect is subtracted is lower overall than it should be. This is because the straightforward conversion of predictions from a log-linear econometric model into cable rates is incorrect.

TAB

JAMES N. DERTOUZOS

EDUCATION

Ph.D., Economics, 1979, Stanford University B.A., Economics, 1972, Rutgers University

PROFESSIONAL EXPERIENCE

September 1979-Present – Senior Economist (1987-present), Assoc. Corporate Research Manager (1990-present), Resident Scholar in Economics (1990-present), Assoc. Head Economics & Statistics Department (1985-1990), RAND, Santa Monica, California
September 1980-Present – Visiting Professor, University of California at Los Angeles
Spring 1981-Present – RAND Graduate School Faculty
Spring 1979 – Visiting Lecturer, Stanford University
September 1978-79 – Post-Doctoral Research Analyst, National Bureau of Economic Research
Spring 1977 – Visiting Lecturer, University of Santa Clara
September 1972-73 – Economist, Bureau of Labor Statistics, U.S. Department of Labor

RESEARCH AREAS

Industrial Organization. Dr. Dertouzos has worked on several topics in industrial organization, including concentration and competition in mass media industries (newspapers, cable, and broadcasting), the economics of technological change, and on the various incentives for merger in the newspaper industry. This work has been sponsored by the Federal Trade Commission, U.S. Department of Labor, and the Small Business Administration.

Labor Markets. Dr. Dertouzos has made several contributions to the literature on labor markets. In work funded by the National Science Foundation, he has analyzed the impact of market conditions and work force characteristics on union preferences for employment versus wages. In addition, research conducted on behalf of the U.S. Department of Labor focused on the effect of technological change on employees displaced from newspaper composing rooms. Most recently, he has conducted research on the legal and economic consequences of the increasing labor market liability of employers. This work has been funded by the Sloan Foundation.

Defense Economics. Dr. Dertouzos has conducted research for the Department of Defense on a variety of issues. He has published papers on the effectiveness of recruiting advertising and on other manpower issues. A primary focus has been on the principal-agent problems associated with the management of Army recruiting personnel. In addition, he is currently working on issues related to the economics of defense acquisition. He is considering a whole range of issues, including the economics of cooperative contractor teaming for research and development and the incentive effects of DOD rules governing the allocation of indirect costs.

PROFESSIONAL ACTIVITIES

July 1974-present – Litigation Consultant (Including Newspaper and Cable Antitrust and Labor Law Issues)
November 1989-March 1991 – Consultant to the National Cable Television Association (Regulatory Proceedings on Effective Competition)
June 1982 – Testimony on Tax Laws and Mergers in the Newspaper Industry (House Ways and Means Subcommittee on Select Revenue Measures)
March 1980 – Testimony on the Impact of Media Concentration (House Small Business General Oversight Subcommittee)
March 1979-August 1979 – Consultant to National Association of Broadcasters (Study of the Recording Industry)
August 1978-December 1979 – Consultant to Federal Trade Commission (Conference on Economics of Mass Communications Industries)

PUBLICATIONS

RAND REPORTS

"Educational Benefits Versus Bonuses: A Comparison of Recruiting Options", WD-5499-FMP, coauthored, October 1991.

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DERTOUZOS/3

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"A Description of Competition in the Newspaper Industry: A Probability Analysis," *Studies in Industry Economics #68*, Department of Economics, Stanford University, June 1976.

"Trends in the Newspaper Industry," *Studies in Industry Economics #57*, Department of Economics, Stanford University, May 1975 coauthored.

TAB

STEVEN S. WILDMAN
CURRICULUM VITA

Office: (708) 491-4262 Home: (708) 673-7006

Department of Communication Studies
Harris Hall
Northwestern University
1881 Sheridan Road
Evanston, IL 60208

52 Williamsburg Road
Evanston, IL 60203

BACKGROUND

Born on December 27, 1948
Married

EDUCATION

B.A.	Economics	Wabash College 1971
M.A.	Economics	Stanford University 1977
Ph.D.	Economics	Stanford University 1980

CURRENT POSITIONS

Associate Professor, Department of Communication Studies, Northwestern University

Director, Program in Telecommunications Science, Management and Policy, Northwestern University

PREVIOUS EXPERIENCE

Senior Economist, Economists Incorporated	1983-88
Assistant Professor, Department of Economics UCLA	1979-83
Consultant to Rand Corporation	1981-83

FELLOWSHIPS and AWARDS

National Science Foundation Fellowship 1974-1977

Ameritech Research Professorship, 1989-90, Northwestern University

Ameritech Research Fellow, 1990-91, Northwestern University

BOOKS

INTERNATIONAL TRADE IN FILMS AND TELEVISION PROGRAMS, with Stephen E. Siwek, Ballinger, 1988.[1]

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[1] Senior author.

[2] Equal joint author.

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